APPLICATION FOR OSHPD SPECIAL SEISMIC CERTIFICATION PREAPPROVAL (OSP)

OFFICE USE ONLY	
APPLICATION #:	OSP – 0289 – 10

OSHPD Special Seismic Certification Preapproval (OSP)

Type: ☐ New ☒ Renewal

Manufacturer Information

Manufacturer: Tower Tech, Inc.

Manufacturer's Technical Representative: Barry Woods, PE

Mailing Address: PO Box 891810, Oklahoma City, OK 73189

Telephone: (405) 979-2176 Email: bwoods@towertechinc.com

Product Information

Product Name: TTXL Series Cooling Towers

Product Type: Pultruded FRP Cooling Tower

Product Model Number: TTXL-i219xx, i319xx, i419xx, 0419xx, i519xx, 0619xx, 0819xx, & 1019xx on 1ft, 4ft, 6ft, & 8ft leg
(List all unique product identification numbers and/or part numbers)

General Description: Wet cooling tower providing heat transfer (removal) by evaporative cooling. Counterflow mechanical-draft cooling tower constructed of pultruded Fiber Reinforced Polymer (FRP) structural components. Seismic enhancements made to the test units and modifications required to address anomalies observed during the tests shall be incorporated into the production units.

Mounting Description: Rigid floor mounted

Applicant Information

Applicant Company Name: W.E. Gundy & Associates, Inc.

Contact Person: Travis Soppe, PE

Mailing Address: 250 Bobwhite Ct, Suite 100, Boise, ID 83706

Telephone: (208) 342-5989 Email: tsoppe@wegai.com

I hereby agree to reimburse the Office of Statewide Health Planning and Development review fees in accordance with the California Administrative Code, 2013.

Signature of Applicant:  Date: 4/15/2013

Title: Vice President Company Name: W.E. Gundy & Associates, Inc.

California Licensed Structural Engineer Responsible for the Engineering and Test Report(s)

Company Name: Harrison Engineering

Name: Nathan Harrison, SE California License Number: S5171

Mailing Address: 1300 N. Ten Mile, Meridian, ID 83642

Telephone: (208) 888-7107 Email: nathan@harrisoneng.com

Supports and Attachments Preapproval

☐ Supports and attachments are preapproved under OPM- _____
(Separate application for OSHPD Preapproval of Manufacturer's Certification (OPM) of Supports and attachments is required)

☒ Supports and attachments are not preapproved

Certification Method

☒ Testing in accordance with: ☒ ICC-ES AC156

☐ Other (Please Specify): _____

Testing Laboratory

Company Name: UC Berkeley-PEER

Contact Name: Wesley Neighbour

Mailing Address: 1301 S. 46th Street, Building 420, Richmond, CA 94804

Telephone: (510) 665-3409 Email: wdn@berkeley.edu

Seismic Parameters

Design in accordance with ASCE 7-10 Chapter 13: ☒ Yes ☐ No

Design Basis of Equipment or Components (F_p/W_p) = 1.88 @ $^z/_h$=1 and 1.00 @ $^z/_h$=0 (Tall legs > 1ft); 2.03 @ $^z/_h$=1 and 1.15 @ $^z/_h$=0 (Short legs ≤ 1ft)

S_{DS} (Design spectral response acceleration at short period, g) = 1.25 @ $^z/_h$=1 and 2.00 @ $^z/_h$=0 (Tall legs > 1ft); 1.35 @ $^z/_h$=1 and 2.30 @ $^z/_h$=0 (Short legs ≤ 1ft)

a_p (In-structure equipment or component amplification factor) = 2.5

R_p (Equipment or component response modification factor) = 3.0

Ω_0 (System overstrength factor) = 2.5

I_p (Importance factor) = 1.5

z/h (Height factor ratio) = Varies: 1.0 and 0.0

Equipment or Component Natural Frequencies (Hz) = Varies – see attached matrix

Overall dimensions and weight (or range thereof) = Varies – see attached matrix

Equipment or Components @ grade designed in accordance with ASCE 7-10 Chapter 15: ☐ Yes ☒ No

Design Basis of Equipment or Components (V/W) =

S_{DS} (Design spectral response acceleration at short period, g) =

S_{D1} (Design spectral response acceleration at 1 second period, g) =

R (Response modification coefficient) =

Ω_0 (System overstrength factor) =

C_d (Deflection amplification factor) =

I_p (Importance factor) = 1.5

Height to Center of Gravity above base =

Equipment or Component Natural Frequencies (Hz) =

Overall dimensions and weight (or range thereof) =

Tank(s) designed in accordance with ASME BPVC, 2010: ☐ Yes ☒ No

List of Attachments Supporting Special Seismic Certification

☒ Test Report(s) ☒ Drawings ☐ Calculations ☒ Manufacturer's Catalog

☒ Other(s) (Please Specify): SE Certification Letter

OSHPD Approval (For Office Use Only) – **Approval Expires on December 31, 2019**

Signature: Date: June 17, 2013

Print Name: Timothy J. Piland Title: SSE

Special Seismic Certification Valid Up to : S_{DS} (g) = See Application z/h = See Application

Condition of Approval (if applicable):

TOWER TECH TTXL SERIES COOLING TOWERS
CERTIFIED PRODUCT MATRIX

WEGAI
W.E. GUNDY & ASSOCIATES, INC.
STRUCTURAL & EARTHQUAKE ENGINEERING

Model Number	Fan Information			General Dimensions (ft)			Operating Weight (lbs)	Representative UUT
	# Fans	HP	kW	Width	Length	Variable Height		
i21930	2	6.0	4.4	84	162	144, 180, 204, 228	8,610-9,610	
i21950	2	10.0	7.4	84	162	144, 180, 204, 228	8,610-9,610	
i21975	2	15.0	11.2	84	162	144, 180, 204, 228	8,610-9,610	UUT-1A, UUT-1B
i31930	3	9.0	6.6	84	231	144, 180, 204, 228	11,930-13,130	
i31950	3	15.0	11.1	84	231	144, 180, 204, 228	11,930-13,130	
i31975	3	22.5	16.8	84	231	144, 180, 204, 228	11,930-13,130	
i41930	4	12.0	8.8	84	300	144, 180, 204, 228	15,340-16,640	
i41950	4	20.0	14.8	84	300	144, 180, 204, 228	15,340-16,640	
i41975	4	30.0	22.4	84	300	144, 180, 204, 228	15,340-16,640	
41930	4	12.0	8.8	144	162	144, 180, 204, 228	12,560-13,760	
41950	4	20.0	14.8	144	162	144, 180, 204, 228	12,560-13,760	
41975	4	30.0	22.4	144	162	144, 180, 204, 228	12,560-13,760	
i51930	5	15.0	11.0	84	369	144, 180, 204, 228	18,860-20,160	
i51950	5	25.0	18.5	84	369	144, 180, 204, 228	18,860-20,160	
i51975	5	37.5	28.0	84	369	144, 180, 204, 228	18,860-20,160	
61930	6	18.0	13.2	144	231	144, 180, 204, 228	18,430-19,730	
61950	6	30.0	22.2	144	231	144, 180, 204, 228	18,430-19,730	
61975	6	45.0	33.6	144	231	144, 180, 204, 228	18,430-19,730	
81930	8	24.0	17.6	144	300	144, 180, 204, 228	24,400-25,700	UUT-2B, UUT-3A
81950	8	40.0	29.6	144	300	144, 180, 204, 228	24,400-25,700	UUT-2B, UUT-3A
81975	8	60.0	44.8	144	300	144, 180, 204, 228	24,400-25,700	UUT-2B, UUT-3A
101930	10	30.0	22.0	144	369	144, 180, 204, 228	30,360-31,660	
101950	10	50.0	37.0	144	369	144, 180, 204, 228	30,360-31,660	
101975	10	75.0	56.0	144	369	144, 180, 204, 228	30,360-31,660	

Notes:

1) Model numbers begining with ' i ' represent inline construction of the fans with all other units constructed with two rows of fans. The first digit in the model number identifies the number of fans in the tower (2, 3, 4, 5, 6, 8, and 10). The last four digits in the model number identifies the fan type (1930, 1950, and 1975). Note that UUT-2 and UUT-3 are 8 fan models and contained all three fan types, 2 - 1930's, 2 - 1950's, and 4 - 1975's.

2) Cooling towers are constructed of pultruded FRP material.

TOWER TECH TTXL SERIES COOLING TOWERS
CERTIFIED SUBCOMPONENT MATRIX

WEGAI
W.E. GUNDY & ASSOCIATES, INC.
STRUCTURAL & EARTHQUAKE ENGINEERING

60 Hz Fan Models

Model	Multiwing Fan Part Number	Baldor Motor Part Number	HP	VOLTS	Weight (lbs)	Representative UUT
TTXL-xx1930	57.5/3-6/30^0/PPG/7WR	77H119W100	3Hp	230/460	267	UUT-2A, UUT-2B, UUT-3A
TTXL-xx1950	57.5/6-6/29^0/PPG/7WR	77H112W104H2	5Hp	230/460	294	UUT-2A, UUT-2B, UUT-3A
TTXL-xx1975	57.5/8-8/29^0/PPG/7WR	77H112W094	7.5Hp	230/460	303	UUT-1A, UUT-1B, UUT-2A, UUT-2B, UUT-3A

CONTROL PANEL

Model	Description / Material / Manufacturer	Enclosure Width	Enclosure Length	Enclosure Height	Weight (lbs)	Representative UUT
T9900	10" PLC / DK Controls / NEMA1 Carbon Steel Enclosure / DK Controls	8"	30"	36"	na	UUT-2A, UUT-2B, UUT-3A

DRIFT ELIMINATOR & FILL MEDIA

Model	Description / Material / Manufacturer	Width	Length	Height	Weight (lbs)	Representative UUT
CF1900	Fill Media / Plastic PVC / Brentwood	12"	72"	12"	10.8	UUT-1A, UUT-1B, UUT-2A, UUT-2B, UUT-3A
DE-080	Drift Eliminator / Plastic PVC / Brentwood	12"	36"	5.5"	3.7	UUT-1A, UUT-1B, UUT-2A, UUT-2B, UUT-3A

COLLECTORS

Model	Description / Material / Manufacturer	Width	Length	Height	Weight (lbs)	Representative UUT
Collector	Water Collector / Plastic ABS / Tower Tech	72" - 132"	144" - 348"	14"	na	UUT-1A, UUT-1B, UUT-2A, UUT-2B, UUT-3A

PVC PIPING

Model	Description / Material / Manufacturer	Diameter	SCH	Length	Weight (lbs)	Representative UUT
4" SCH40 Pipe	Top tower water pipe / PVC / Generic	4"	40	Varies	Varies	Interpolated
6" SCH40 Pipe	Top tower water pipe / PVC / Generic	6"	40	Varies	Varies	UUT-1A, UUT-1B, UUT-2A, UUT-2B, UUT-3A
8" SCH40 Pipe	Top tower water pipe / PVC / Generic	8"	40	Varies	Varies	Interpolated
10" SCH40 Pipe	Top tower water pipe / PVC / Generic	10"	40	Varies	Varies	UUT-2A, UUT-2B, UUT-3A
12" SCH40 Pipe	Top tower water pipe / PVC / Generic	12"	40	Varies	Varies	UUT-2A, UUT-2B, UUT-3A

TOWER TECH TTXL SERIES COOLING TOWERS
CERTIFIED SUBCOMPONENT MATRIX

WEGAI
W.E. GUNDY & ASSOCIATES, INC.
STRUCTURAL & EARTHQUAKE ENGINEERING

ROTARY DISCONECT

Model	Description / Material / Manufacturer	Width	Length	Height	Weight (lbs)	Representative UUT
Rotary Disconnect	Electrical disconnect / PVC / Salzer USA	3"	4"	6"	na	UUT-1A, UUT-1B

SUMP BOX

Model	Description / Material / Manufacturer	Width	Length	Height	Weight (lbs)	Representative UUT
Sump Box	Sump Box / Plastic ABS / Tower Tech	28.25"	4"	36.5"	na	UUT-1A, UUT-1B

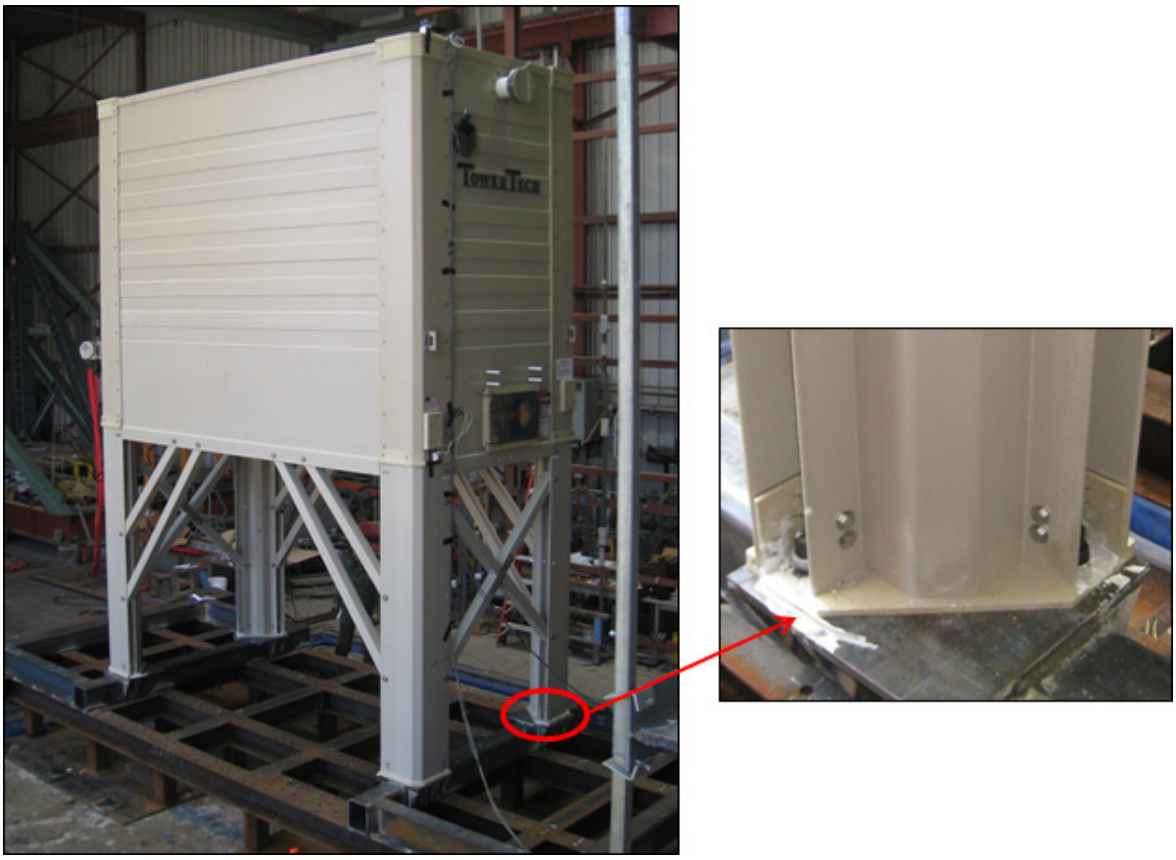
STRUCTURAL TOWER FRAME

Model	Description / Material / Manufacturer	Height x Width x Thick	Length	Weight (lbs)	Representative UUT
Basin	Side wall basin / Creative Pultrusions, Inc.	Pultruded 47" x 11.25" x 0.25"	64" - 340"	na	UUT-1A, UUT-1B, UUT-2A, UUT-2B, UUT-3A
Cross Basin	Middle basin / Creative Pultrusions, Inc.	Pultruded 33.25" x 9.25" x 0.25"	64" or 124"	na	UUT-1A, UUT-1B, UUT-2A, UUT-2B, UUT-3A
Top Wall	Side walls / Creative Pultrusions, Inc.	Pultruded 43.25" x 0.25"	64" - 340"	na	UUT-1A, UUT-1B, UUT-2A, UUT-2B, UUT-3A
Mid Wall	Side walls / Creative Pultrusions, Inc.	Pultruded 47.25" x 0.25"	64" - 340"	na	UUT-1A, UUT-1B, UUT-2A, UUT-2B, UUT-3A
Leg	Leg columns / Creative Pultrusions, Inc.	Pultruded 15" x 15" x 0.375"	15" - 100"	na	UUT-1A, UUT-1B, UUT-2A, UUT-2B, UUT-3A
Brace	Square tube brace / Creative Pultrusions, Inc.	Pultruded 3.5" x 3.5" x 0.375"	55.5" - 83.5"	na	UUT-1A, UUT-1B, UUT-2A, UUT-2B, UUT-3A

Notes:
Structural frames are pultruded Fiber Reinforced Polymer (FRP) with a minimum Lengthwise (LW) tensile strength of 35ksi @ 77^{o}F and a minimum Crosswise (CW) tensile strength of 15ksi @ 77^{o}F.

UUT-1A	UNIT UNDER TEST (UUT) SUMMARY SHEET	WEGAI W.E. Gundy & Associates, Inc. Structural & Earthquake Engineering

Mounting Details: Cooling tower supported on 8ft legs and anchored to the foundation with 2 - 1" diameter anchor bolts on each leg.



Manufacturer: Tower Tech, Inc.

Product Line: TTXL SERIES COOLING TOWERS

Identification Number: TTXL-i21975, SN 2012019-01

UUT Function: Wet cooling tower - Heat transfer (removal) by evaporative cooling

UUT Description: 2 Fan Inline Tower mounted on 8ft legs. Water mass was represented using sand bags placed on top of the collector system.

UUT Component Description: Tower constructed of pultruded FRP components, 2 - TTXL-xx1975 7.5Hp fans, CF1900 fill media, DE-080 drift eliminator, collector media, 6" SCH40 PVC piping, and rotary disconnects.

UUT PROPERTIES

Weight (lb)	Dimensions (inches)			Natural Fequency (Hz)		
	Width	Depth	Height	Short	Long	V
8,910	84	168	228	4.4	6.7	13.4

SEISMIC TEST PARAMETERS (Tested 05-19-2012)

Test Criteria	S_{DS}	z / h	I_P	A_{FLX-H}	A_{RIG-H}	A_{FLX-V}	A_{RIG-V}
ICC-ES AC156 2012	2.40	0.0	1.5	2.40	0.96	1.60	0.64
ICC-ES AC156 2012	1.50	1.0	1.5	2.40	1.80	1.00	0.41

Note: The cooling tower maintained structural integrity and functionality after the ICC-ES AC156 Test.

UUT-1B	UNIT UNDER TEST (UUT) SUMMARY SHEET	WEGAI W.E. Gundy & Associates, Inc. Structural & Earthquake Engineering

Mounting Details: Cooling tower supported on 1ft legs and anchored to the foundation with 2 - 1" diameter anchor bolts on each leg.

Manufacturer: Tower Tech, Inc.

Product Line: TTXL SERIES COOLING TOWERS

Identification Number: TTXL-i21975, SN 2012019-01

UUT Function: Wet cooling tower - Heat transfer (removal) by evaporative cooling

UUT Description: 2 Fan Inline Tower mounted on 1ft legs. Water mass was represented using sand bags placed on top of the collector system.

UUT Component Description: Tower constructed of pultruded FRP components, 2 - TTXL-xx1975 7.5Hp fans, CF1900 fill media, DE-080 drift eliminator, collector media, 6" SCH40 PVC piping, and rotary disconnects.

UUT PROPERTIES

Weight (lb)	Dimensions (inches)			Natural Fequency (Hz)		
	Width	Depth	Height	Short	Long	V
7,910	84	168	144	7.7	8.1	13.4

SEISMIC TEST PARAMETERS (Tested 05-19-2012)

Test Criteria	S_{DS}	z / h	I_P	A_{FLX-H}	A_{RIG-H}	A_{FLX-V}	A_{RIG-V}
ICC-ES AC156 2012	2.50	1.0	1.5	4.00	3.00	1.67	0.67

Note: The cooling tower maintained structural integrity and functionality after the ICC-ES AC156 Test.

UUT-2B	UNIT UNDER TEST (UUT) SUMMARY SHEET	WEGAI W.E. Gundy & Associates, Inc. Structural & Earthquake Engineering

Mounting Details: Cooling tower supported on 1ft legs and anchored to the foundation with 2 - 1" diameter anchor bolts on each leg.

Manufacturer: Tower Tech, Inc.

Product Line: TTXL SERIES COOLING TOWERS

Identification Number: TTXL-081975, SN 2012018-01

UUT Function: Wet cooling tower - Heat transfer (removal) by evaporative cooling

UUT Description: 8 Fan Tower mounted on 1ft legs. Water mass was represented using sand bags placed on top of the collector system.

UUT Component Description: Tower constructed of pultruded FRP components, 2 - TTXL-xx1930 3Hp fans, 2 - TTXL-xx1950 5Hp fans, 4 - TTXL-xx1975 7.5Hp fans, T9900 control panel, CF1900 fill media, DE-080 drift eliminator, collector media, and 6"-10"-12" SCH40 PVC piping.

UUT PROPERTIES

Weight (lb)	Dimensions (inches)			Natural Fequency (Hz)		
	Width	Depth	Height	Short	Long	V
22,200	144	306	144	3.9	5.4	10.7

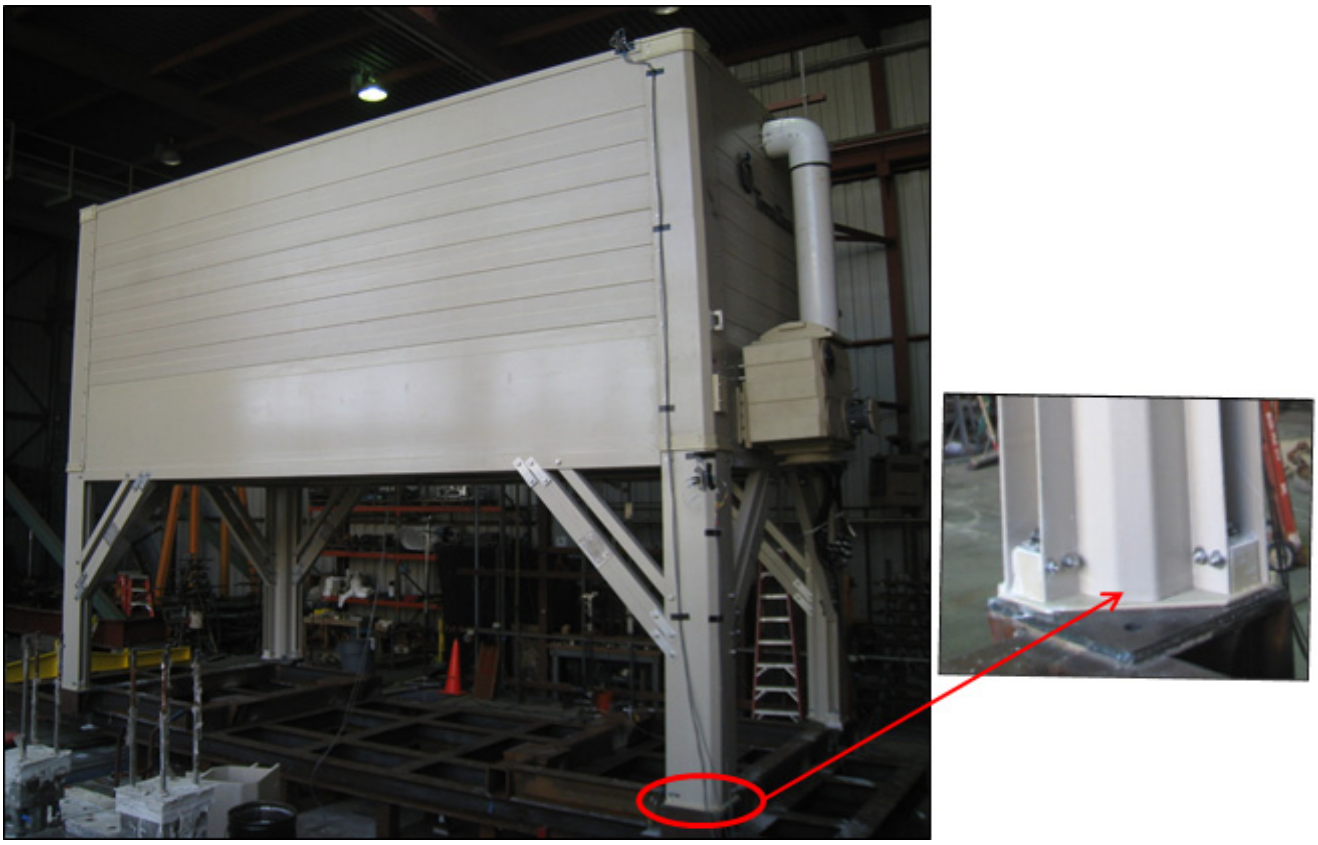
SEISMIC TEST PARAMETERS (Tested 05-22-2012)

Test Criteria	S_{DS}	z / h	I_P	A_{FLX-H}	A_{RIG-H}	A_{FLX-V}	A_{RIG-V}
ICC-ES AC156 2012	2.30	0.0	1.5	2.30	0.92	1.53	0.62
ICC-ES AC156 2012	1.35	1.0	1.5	2.16	1.62	0.90	0.36

Note: The cooling tower maintained structural integrity and functionality after the ICC-ES AC156 Test.

UUT-3A	UNIT UNDER TEST (UUT) SUMMARY SHEET	WEGAI W.E. Gundy & Associates, Inc. Structural & Earthquake Engineering

Mounting Details: Cooling tower supported on 8ft legs and anchored to the foundation with 2 - 1" diameter anchor bolts on each leg.



Manufacturer: Tower Tech, Inc.

Product Line: TTXL SERIES COOLING TOWERS

Identification Number: TTXL-081975, SN 2012053-01

UUT Function: Wet cooling tower - Heat transfer (removal) by evaporative cooling

UUT Description: 8 Fan Tower mounted on 8ft legs. Water mass was represented using rock salt placed in the water basins.

UUT Component Description: Tower constructed of pultruded FRP components, 2 - TTXL-xx1930 3Hp fans, 2 - TTXL-xx1950 5Hp fans, 4 - TTXL-xx1975 7.5Hp fans, T9900 control panel, CF1900 fill media, DE-080 drift eliminator, collector media, and 6"-10"-12" SCH40 PVC piping.

UUT PROPERTIES

Weight (lb)	Dimensions (inches)			Natural Fequency (Hz)		
	Width	Depth	Height	Short	Long	V
23,400	84	168	228	3.3	3.7	21.7

SEISMIC TEST PARAMETERS (Tested 01-29-2013)

Test Criteria	S_{DS}	z / h	I_P	A_{FLX-H}	A_{RIG-H}	A_{FLX-V}	A_{RIG-V}
ICC-ES AC156 2012	2.00	0.0	1.5	2.00	0.80	1.34	0.54
ICC-ES AC156 2012	1.25	1.0	1.5	2.00	1.50	0.84	0.34

Note: The cooling tower maintained structural integrity and functionality after the ICC-ES AC156 Test.